

1. A method of applying liquid to a substrate, comprising:  
pumping liquid through a dispensing path in a manifold to a  
dispensing module;  
intermittently cycling a dispensing valve of the dispensing module  
5 between an open condition for applying liquid from the dispensing module to  
the substrate and a closed condition for returning liquid from the dispensing  
module to a recirculation path in the manifold; and  
preventing backflow of liquid from the recirculation path to the  
dispensing module when the dispensing valve is cycling from the open  
10 condition to the closed condition.
2. The method of claim 1, wherein the liquid is a hot melt adhesive.
3. The method of claim 1, further comprising:  
maintaining a pressure of liquid in the recirculation path greater  
than a pressure of liquid in the dispensing path as the dispensing valve is  
cycled from the open condition to the closed condition.
4. The method of claim 1, further comprising:  
maintaining a pressure of liquid in the recirculation path greater  
than a pressure of liquid in the dispensing path when the dispensing valve is in  
the open condition.

5. The method of claim 1, further comprising:  
maintaining a pressure of liquid in the recirculation path less than a pressure of liquid in the dispensing path when the dispensing valve is in the closed condition.
6. The method of claim 1, wherein preventing backflow of liquid further comprises positioning a check valve in the recirculation path.
7. The method of claim 6, further comprising:  
sensing whether the check valve is open or closed.
8. The method of claim 6, further comprising:  
maintaining a pressure of liquid in the recirculation path greater than a pressure of liquid in the dispensing path as the dispensing valve is cycled from the open condition to the closed condition.
9. The method of claim 1, wherein liquid is pumped from a supply channel to the dispensing path and the recirculation path returns liquid to the supply channel.
10. The method of claim 1, wherein liquid is pumped from a supply channel to the dispensing path and the recirculation path returns liquid to a recirculation channel isolated from the supply channel.

11. A method of applying liquid to a substrate, comprising:  
coupling a plurality of manifold segments in a side-by-side relationship in which the manifold segments share a supply channel carrying liquid;  
pumping liquid from the supply channel through a dispensing path  
5 coupling each of the manifold segments with a corresponding one of a plurality of dispensing modules;  
intermittently cycling at least one of the dispensing modules between an open condition for applying liquid from the dispensing module to the substrate and a closed condition for returning liquid from the dispensing  
10 module to the supply channel through a recirculation path; and  
preventing backflow of liquid from the recirculation path to the dispensing module when the dispensing valve is cycling from the open condition to the closed condition.
12. The method of claim 11, further comprising:  
maintaining a pressure of liquid in the recirculation path greater than a pressure of liquid in the dispensing path as the dispensing valve is cycled from the open condition to the closed condition.
13. The method of claim 11, wherein preventing backflow of liquid further comprises positioning a check valve in the recirculation path.

14. The method of claim 13, further comprising:  
sensing whether the check valve is open or closed.
15. The method of claim 13, further comprising:  
maintaining a pressure of liquid in the recirculation path greater  
than a pressure of liquid in the dispensing path.
16. The method of claim 10, wherein the liquid is a hot melt adhesive.

17. An apparatus for applying liquid to a substrate, comprising:
- a plurality of modular manifolds arranged side-by-side for sharing a supply channel carrying liquid, each of said modular manifolds including a recirculation passageway coupled in fluid communication with said supply
- 5 channel, a distribution passageway, and a pump operative for pumping liquid from said supply channel to said distribution passageway;
- a plurality of dispensing modules each including an inlet and a recirculation outlet coupled in fluid communication with said distribution passageway and said recirculation passageway, respectively, of one of said
- 10 modular manifolds; and
- a plurality of check valves, one of each of said check valves positioned in said recirculation outlet of a corresponding one of said plurality of dispensing modules.

18. An apparatus for applying liquid to a substrate, comprising:
- a plurality of modular manifolds arranged side-by-side for sharing a supply channel carrying liquid, each of said modular manifolds including a recirculation passageway coupled in fluid communication with said supply
- 5 channel, a distribution passageway, and a pump operative for pumping liquid from said supply channel to said distribution passageway;
- a plurality of dispensing modules each including an inlet and a recirculation outlet coupled in fluid communication with said distribution passageway and said recirculation passageway, respectively, of one of said
- 10 modular manifolds; and
- a plurality of check valves, one of each of said check valves positioned in said recirculation passageway of a corresponding one of said plurality of manifold segments.

19. An apparatus for applying liquid to a substrate, comprising:  
a manifold including a supply channel carrying liquid, a  
recirculation passageway, a distribution passageway, and a pump operative for  
pumping liquid from said supply channel to said distribution passageway;
- 5 a dispensing module including an inlet coupled in fluid  
communication with said distribution passageway and a recirculation outlet  
coupled in fluid communication with said recirculation passageway; and  
a check valve positioned in at least one of said recirculation outlet  
and said recirculation passageway.
20. The apparatus of claim 19, wherein said recirculation passageway  
is coupled in fluid communication with said supply channel.
21. The apparatus of claim 19, further comprising:  
a check valve position sensor located relative to said check valve  
to detect when said check valve has opened and allowed the liquid to enter  
said recirculation passageway from said distribution passageway.

22. An apparatus for applying liquid to a substrate, comprising:  
a manifold including a supply channel carrying liquid, a plurality of recirculation passageways, a plurality of distribution passageways, and at least one pump operative for pumping liquid from said supply channel to each of said distribution passageways;  
a plurality of dispensing modules each including an inlet coupled in fluid communication with one of said distribution passageways and a recirculation outlet coupled in fluid communication with one of said recirculation passageways; and  
a plurality of check valves, one of each of said check valves positioned in a corresponding one of said recirculation passageways of said manifold.
23. The apparatus of claim 22, wherein each of said plurality of recirculation passageways is coupled in fluid communication with said supply channel.
24. The apparatus of claim 22, further comprising:  
a plurality of check valve sensors, each sensor located relative to a corresponding one of said check valves to detect when said corresponding one of said check valves has opened and allowed the liquid to enter said corresponding one of said recirculation passageways and a corresponding one of said distribution passageways.



25.           An apparatus for applying liquid to a substrate, comprising:  
a manifold including a supply channel carrying liquid, a plurality of recirculation passageways, a plurality of distribution passageways, and at least one pump operative for pumping liquid from said supply channel to each of said distribution passageways;  
5           a plurality of dispensing modules each including an inlet coupled in fluid communication with one of said distribution passageways and a recirculation outlet coupled in fluid communication with one of said recirculation passageways; and  
10           a plurality of check valves, one of each of said check valves positioned in said recirculation outlet of a corresponding one of said dispensing modules.
26.           The apparatus of claim 25, wherein each of said plurality of recirculation passageways is coupled in fluid communication with said supply channel.
27.           The apparatus of claim 25, further comprising:  
a plurality of check valve sensors, each sensor located relative to a corresponding one of said check valves to detect when said corresponding one of said check valves has opened and allowed the liquid to enter said  
5           corresponding one of said recirculation passageways and a corresponding one of said distribution passageways.

28.           An apparatus for applying liquid to a substrate, comprising:
- a plurality of modular manifolds arranged side-by-side for sharing
- a supply channel carrying liquid, each of said modular manifolds including a
- recirculation passageway coupled in fluid communication with said supply
- 5       channel, a distribution passageway, and a pump operative for pumping liquid
- from said supply channel to said distribution passageway;
- a plurality of dispensing modules each including an inlet and a
- recirculation outlet coupled in fluid communication with said distribution
- passageway and said recirculation passageway, respectively, of one of said
- 10       modular manifolds;
- an adapter plate having a plurality of recirculation passageways
- each coupling said recirculation passageway of one of said plurality of modular
- manifolds with said recirculation outlet of a corresponding one of said
- dispensing modules; and
- 15           a plurality of check valves, one of each of said check valves
- positioned in a corresponding one of said recirculation passageways of said
- adapter plate.

29. An apparatus for applying liquid to a substrate, comprising:  
a manifold including a supply channel carrying liquid, a  
recirculation passageway, a distribution passageway, and a pump operative for  
pumping liquid from said supply channel to said distribution passageway;  
5 a dispensing module an inlet coupled in fluid communication with  
said distribution passageway and a recirculation outlet coupled in fluid  
communication with said recirculation passageway;  
an adapter plate having a recirculation passageway coupling said  
recirculation passageway with said recirculation outlet; and  
10 a check valve positioned in said recirculation passageway of said  
adapter plate.

30. The apparatus of claim 29, wherein each of said plurality of  
recirculation passageways is coupled in fluid communication with said supply  
channel.

31. An apparatus for applying liquid to a substrate, comprising:
- a manifold including a supply channel carrying liquid, a plurality of recirculation passageways, a plurality of distribution passageways, and at least one pump operative for pumping liquid from said supply channel to each of said distribution passageways;
- 5 a plurality of dispensing modules each including an inlet coupled in fluid communication with one of said distribution passageways and a recirculation outlet coupled in fluid communication with one of said recirculation passageways; and
- an adapter plate having a plurality of recirculation passageways
- 10 each coupling said recirculation passageway of one of said manifold with said recirculation outlet of a corresponding one of said dispensing modules; and
- a plurality of check valves, one of each of said check valves positioned in a corresponding one of said recirculation passageways of said adapter plate.
32. The apparatus of claim 31, wherein each of said plurality of recirculation passageways is coupled in fluid communication with said supply channel.

33.           A method of applying liquid to a substrate, comprising:  
                  pumping liquid through a dispensing path extending through a  
manifold and a dispensing module;  
                  cycling the dispensing module to an open condition thereby  
dispensing liquid from the dispensing module to the substrate;  
5               cycling the dispensing module to a recirculating condition  
preventing liquid from dispensing onto the substrate;  
                  returning liquid from the dispensing module to a recirculation path  
in the manifold while the dispensing module is in the closed condition; and  
                  sending a signal to a control coupled with the dispensing module  
10           indicating that the dispensing module is in the recirculating condition.

34.           The method of claim 33, wherein the dispensing module further  
comprises a movable valve element configured to selectively place the  
dispensing module in the recirculating condition and further comprising:  
                  magnetically sensing a change in the position of the movable  
5           valve element, and  
                  sending the signal after magnetically sensing the change in the  
position of the movable valve element.

35. The method of claim 33, wherein the dispensing module further comprises a movable valve element configured to selectively place the dispensing module in the recirculating condition and further comprising:

electrically sensing a change in the position of the movable valve  
5 element, and  
sending the signal after electrically sensing the change in the position of the movable valve element.

36. The method of claim 33, wherein the dispensing module further comprises a movable valve element configured to selectively place the dispensing module in the recirculating condition and further comprising:

acoustically sensing a change in the position of the movable valve  
5 element, and  
sending the signal after acoustically sensing the change in the position of the movable valve element.